DOI: 10.14260/jemds/2015/1440

ORIGINAL ARTICLE

COMPUTED TOMOGRAPHIC EVALUATION OF MEDIASTINAL MASSES

Shashikumar M. R[1], Rajendra Kumar N. L [2], Nanjaraj C. P[3], C. N. Pradeep Kumar[4], Manupratap N[5], Chandrashekar H. M[6]

HOW TO CITE THIS ARTICLE:
Shashikumar M. R, Rajendra Kumar N. L , Nanjaraj C. P, C. N. Pradeep Kumar, Manupratap N, Chandrashekar H. M. "Computed Tomographic Evaluation of Mediastinal Masses". Journal of Evolution of Medical and Dental Sciences 2015; Vol. 4, Issue 57, July 16; Page: 9951-9962, DOI: 10.14260/jemds/2015/1440

ABSTRACT: OBJECTIVES: The objectives of our study being categorization of the masses according to the mediastinal compartments, study their CT characteristics and to compare the CT findings with histopathological findings. **MATERIALS AND METHODS:** Patients who were suspected to have a mediastinal mass either on clinical examination or on the basis of an abnormal chest radiograph. Thorough clinical history and clinical examination of the patients was done before CT examination. The images were studied in mediastinal, lung and bone window settings. Biopsy of the masses was taken wherever possible. **RESULTS:** Our study included a total of 50 cases, 31males and 19 females. Cough (n=35, 70%) and dyspnoea (n=28, 46%) were the major presenting complaints. Anterior mediastinum (n=15, 39.4%) is the most commonly involved compartment followed by posterior mediastinum (n=12, 31.5%) and middle mediastinum (n=11, 28.9%). Trans compartmental involvement is more commonly seen involving the anterior and middle mediastinum. The majority of the mediastinal masses are well defined (n=36, 72%), with soft tissue (n=34, 68%) attenuation on plain CT, showing heterogeneous enhancement (n=22, 44%) on contrast study. Masses involved the adjacent structures in 48% cases (n=24) and associated lung findings and bony changes were seen in 64% (n=32) and 14% cases (n=7) respectively. **CONCLUSION:** To conclude, CT is an important modality in the evaluation of mediastinal masses for their exact localization, analyzing their morphology and arriving at a provisional diagnosis for optimal patient management.

KEYWORDS: Computed Tomography, Mediastinum, Histopathology.

INTRODUCTION: Mediastinal masses span a wide histopathological and radiological spectrum.[1] The mediastinum is demarcated by the pleural cavities laterally, the thoracic inlet superiorly and the diaphragminferiorly. It is further divided into anterior, middle and posterior compartments by many anatomists.[2] Anterior mediastinal tumours account for 50% of all mediastinal masses, including thymoma, teratoma, thyroid disease and lymphoma.[3] Masses of the middle mediastinum are typically congenital cysts while those arising in the posterior mediastinum are often neurogenic tumours.[4]

Although conventional radiography may allow detection of or suggest the presence of a mediastinal mass, in most cases it is of limited use in determining the exact nature and extent of a lesion. CT and, more recently magnetic resonance imaging (MRI) enable accurate depiction of masses in the mediastinum as well as precise demonstration of the relationship of such masses to adjacent vital structures. The CT appearance of the mass often provides enough information to allow a specific diagnosis to be made.[5]

Characterisation on CT is based on specific attenuation of air, fat, water and calcium. High-resolution Multiplan are formation images display the detailed anatomical relationship of the tumour with the adjacent structures. An excellent soft tissue contrast also designates MRI as an ideal tool to evaluate tumours of the mediastinum.[6]

DOI: 10.14260/jemds/2015/1440

MATERIALS AND METHODS: Patients who were suspected have a mediastinal mass either on clinical examination or on the basis of an abnormal chest radiograph were included in the study. Our study was conducted Mysore Medical College and Research Institute (MMCRI) Mysore, between November 2012 to May. 2014. Informed consent was obtained from the patients. Thorough clinical history and clinical examination were done before CT examination. CT examination was done using GE high speed dual slice CT scanner. All cardiac and traumatic cases were excluded from our study. For contrast study, 80-130ml intravenous injection of Iopamidol (Iopamiro)/Iopramide (Ultravist) at a dose of 300mg of Iodine/Kg body weight was given. Sagittal and coronal reconstructions were made wherever necessary.

The scans were reviewed on a direct display console in multiple window settings (i.e. soft tissue (Mediastinal) window (Level 30HU-50 HU; width 350 HU-500 HU), lung window (Level 700 HU; width 1,500 HU). and bone window (Level 2,400 HU; width 200 HU) to examine the wide variation of tissue density and also to look for osseous involvement. The pre and post contrast attenuation values, the size, location of the mass, presence of calcification, mass effect on adjoining structures and others associated findings were studied. Because lung cancer may metastasize to the adrenal glands, scanning was continued through to the adrenals in patients with a history of cancer.

Biopsy of the masses was taken wherever possible using 20 G needle and CT diagnosis was compared with histopathological findings.

RESULTS: Our study included a total of 50 cases, 31males and 19 females. Cough (n=35, 70%) and dyspnoea (n=28, 46%) were the major presenting complaints. We categorized the masses into anterior, middle, posterior and transcompartmental masses. Anterior mediastinum is the most commonly involved compartment (n=27, 42.2%), followed by middle (n=23, 35.9%) and posterior mediastinum (n=14, 21.8%). Isolated compartmental involvement is common in anterior mediastinum (n=15, 39.4%) followed by the posterior mediastinum (n=12, 31.5%) and middle mediastinum (n=11, 28.9%). Thymic masses (n=7, 46.6%), aneurysms (n=6, 54.5%) and nerve sheath tumors (n=4, 33.3%) are the most common masses to have isolated compartmental involvement of the anterior, middle and posterior mediastinum respectively.

Transcompartmental involvement is more commonly seen involving the anterior and middle mediastinum. The most common mass to involve both anterior and middle mediastinum was found to be lymphomas (n=6, 60%). A single case of lymphoma and aortic aneurysm each were found to involve all the compartments.

The majority of the mediastinal masses are well defined (n=36, 72%), with soft tissue (n=34, 68%) attenuation on plain CT, showing heterogeneous enhancement (n=22, 44%) on administration of intravenous contrast. Involvement of the adjacent structures was seen in 48% cases (n=24), associated lung findings in 64% cases (n=32) and bony changes in 14% cases (n=7).

DISCUSSION: Mediastinal masses represent a wide diversity of disease state. The clinical spectrum of mediastinal masses can range from being asymptomatic to producing compressive symptoms. The location and composition of a mass are critical in narrowing the differential diagnosis. Although many of these masses have similar imaging appearances, clinical history, anatomical position and certain details seen at imaging allow correct diagnosis in many cases.

Although chest radiography is used in the initial detection of mediastinal mass their further evaluation needs computed tomography. Computed tomography plays an important role in the

evaluation of mediastinal masses in terms of their distribution, their further characterization and distinguishing benign and malignant lesions. CT gives clear delineation of lesions and distinguishes them better from normal structures. An excellent soft tissue contrast designates MRI as an ideal tool to evaluate tumors of the mediastinum, assessment of preoperative relationships with the pericardium, heart cavities, spinal cord and vascular structures. Chemical-shift MRI has been shown to be useful in distinguishing normal thymus and thymic hyperplasia from thymic neoplasms and lymphoma.[7]

Percutaneous needle biopsy with imaging guidance allows access to lesions in virtually all mediastinal locations. Mediastinal biopsies performed by using the parasternal approach are usually performed with CT guidance.[8]

In our study most common age group was 41-60year of age, which is comparable to study by Harmeet et al. However, in our study only 6% cases were seen in >61yrs of age whereas Harmeet Kaur et al found 31.6% cases in >61yrs age group.[9] We found that cough (70% cases) and dyspnea (56%) were the two major presenting complaints. This is in accordance with the study by Kiran et al[10] However, Davis et al,[11] found that chest pain as the most common presenting symptom (30%) followed by fever (20%).

We found that anterior mediastinum is the most commonly involved compartment (n=27, 42.2%), followed by middle (n=23, 35.9%) and posterior mediastinum (n=14, 21.8%). This correlated with a study conducted by Strollo et al[12] and Kiran et al.

In the present study vascular masses are the most common mediastinal masses (n=10, 20%) followed by lymphomas (n=9, 18%) and thymic masses (n=7, 14%).

Thymic masses constitute 14% of cases which is comparable to study conducted by Kiran et al and Dutta et al.[13]

Thyroid masses constitute 10% of cases which is comparable to study by Benjamin et al.[14] Lymphomas constitute 18% of mediastinal masses which is comparable to study by Benjamin et al and Cohen et al.[15]

Germ cell tumors and neurogenic tumors constitute 4% and 8% of cases which is comparable to study by Dutta et al.

CT Characteristics: In the present study, most cases are well defined masses (n=38, 72%). Masses have soft tissue attenuation (n= 34, 68%), cystic areas (n=23, 46%), calcifications (n=22, 44%) and fat density (n=2, 4%) in decreasing order of frequency. Masses showed heterogeneous (n= 22, 44%), homogenous (n=11, 22%), rim (n=7, 14%) and intense enhancement (n=10, 20%). Involvement of adjacent structures of the mediastinal masses was noted in 48% (n=24) cases, associated lung and pleural findings in 64% (n=32) cases and bone changes in 15% (n=7) cases.

CT and HPR Diagnosis: A total of 35 cases are verified histologically. CT findings were comparable with histopathological findings in 32 cases. In two cases, difficulties arose in determining the exact nature of the mass on CT with lymphoma and thymic mass being considered as the differentials. Biopsy of both the masses proved to be lymphomas. Similar difficulty was also encountered in differentiating between bronchogenic and esophageal duplication cyst in a case of cystic mass. On histopathology this particular mass was proven to be a bronchogenic cyst. So histopathology confirmed the diagnosis in 64% cases.

DOI: 10.14260/jemds/2015/1440

CT Diagnosis and Final Diagnosis: The CT diagnosis of 32 cases (64%) correlated with histopathology findings. CT findings were inconclusive in 3 cases (6%) compared with histopathology findings. Vascular masses (n=10, 20%) were confirmed solely based on the CT findings. In 5 cases (10%) CT diagnosis was presumed to be accurate, based on response to appropriate treatment and follow up imaging. Thus CT showed an overall diagnostic accuracy of 94%.

Overall anterior mediastinum is the most common compartment involved followed by middle and posterior mediastinum. Lymphomas and thymomas are the most common masses to involve the anterior mediastinum, aneurysms and lymphnode masses involve the middle mediastinum and nerve sheath tumours involve the posterior mediastinum.

Transcompartmental involvement is seen in lymphnode masses and aneurysms.

Most of the mediastinal masses are well defined, with soft tissue attenuation on plain study, showing heterogeneous enhancement on contrast study. Involvement of the adjacent structures by a mediastinal mass, associated lung and bony findings are better appreciated with the help of CT. CT with an overall accuracy of 94% is an important imaging modality in the evaluation of a mediastinal mass.

Limitation in our study being the limited sample size and our presumption of diagnosis in five cases solely on imaging findings and appropriate treatment.(Mediastinal pseudocysts in two patients with pancreatitis, two cases of paravertebral abscess and a single case of calcified mediastinal lymphadenopathy in a patient with a previous history of tuberculosis).

CONCLUSION: To conclude computed tomography is the imaging modality of choice in evaluating mediastinal mass for their exact localization, studying the morphological features and arriving at a provisional diagnosis for optimal patient management.

REFERENCES:

1. Laurent F et al (1998) Mediastinal masses: diagnostic approach. Eur Radiol 8: 1148–1159.
2. Whiteen CR et al (2007) A diagnostic approach to mediastinal abnormalities. Radiographics 27: 657–671.
3. Tomiyama N et al (2009) An terior mediastinal tumors: diagnostic accuracy of CT and MRI. Eur J Radiol 69: 280–288.
4. Duwe BV et al (2005) Tumors of the mediastinum. Chest 128: 2893–2909.
5. Tecce PM, Fishman EK, Kuhlman JE.CT Evaluation of the Anterior Mediastinum: Spectrum of Disease. Radio Graphics 1994; 14: 973-990.
6. Puderbach M et al (2007) MR imaging of the chest: a practical approach at 1.5 T. Eur J Radiol 64: 345–355.
7. Ackman JB, et al (2011) MRI of the thymus. AJR Am J Roentgenol 197: W15–W20.
8. Gupta S, Seaberg K, Wallace MJ, Madoff DC. Imaging-guided Percutaneous Biopsy of Mediastinal Lesions: Different Approaches and Anatomic Considerations. Radio Graphics 2005; 25: 763–788.
9. Harmeet K, Punit T, Pankaj D, Jasmine G. Computed tomographic evaluation of mediastinal masses/lesions with contrast enhancement and correlation with pathological diagnosis – a study of 120 cases. Journal of Biomedical Graphics and Computing, 2014; 4; 3; 28 – 35.
10. Kiran PS and Kalra VB. Computed Tomographic Evaluation of Mediastinal Lesions. Journal of Evolution of Medical and Dental Sciences/Volume 2/Issue 11/March 18, 2013. 1714-23.

11. Davis Jr RD, Oldham Jr HN, Sabiston Jr DC: Primary cysts and neoplasms of the mediastinum: Recent changes in clinical presentation, methods of diagnosis, management, and results. Ann Thorac Surg 1987; 44: 229-237.
12. Strollo DC, Rosado-de-Christenson ML, Jett JR: Primary mediastinal tumors. Part 1.Tumors of the anterior mediastinum. Chest 1997; 112: 511-522.
13. Dutta P, Patel KK and Choudhury PR. Mediastinal Masses: A Radiological Study of 50 Cases. IJBR 2014; 05; 07; 468 – 473.
14. Benjamin SP, McCormack LJ, Effler DB. Primary tumors of the mediastinum. Chest 1972; 62: 297-303.
15. Cohen AJ, Thompson LN, Edwards FH et al. Primary cysts and tumors of the mediastinum. Ann Thorac Surg 1991; 51: 378-386.

SYMPTOM	NO OF CASES	PERCENTAGE
COUGH	35	70
DYSPNEA	28	56
CHEST PAIN	12	24
FEVER	10	20
HAEMOPTYSIS	7	14

Table 1. Clinical presentation of mediastinal masses

MEDIASTINAL COMPARTMENT	NO OF CASES	PERCENTAGE
ANTERIOR	15	30.0
MIDDLE	11	22.0
POSTERIOR	12	24.0
ANTERIOR + MIDDLE	10	20.0
ANTERIOR + MIDDLE + POSTERIOR	2	4.0
TOTAL	50	100.0

Table 2. Localisation of mediastinal masses

ANTERIOR MEDIASTINUM	MIDDLE MEDIASTINUM	POSTERIOR MEDIASTINUM	ANTERIOR + MIDDLE MEDIASTINUM	ANTERIOR +MIDDLE + POSTERIOR MEDIASTINUM
THYMIC MASSES [7,46.6%]	ANEURYSMS [6,54.5%]	NERVE SHEATH TUMOURS [4,33.3%]	LYMPHOMA [6,60.0%]	ANEURYSM [1,50.0%]
THYROID [5,33.3%]	METASTATIC LN [3,27.2%]	ANEURYSM [3.25.0%]	METASTATIC LN [2,20.0%]	LYMPHOMA [1,50.0%]
TERATOMAS [2,13.3%]	TUBERCULOUS LN [1,9.1%]	PARAVERTEBRAL ABSCESS [2,16.6%]	TUBERCULOUS LN [2,20.0%]	
LYMPHOMA [1,6.6%]	LYMPHOMA [1,9.1%]	MEDIASTINAL PSEUDOCYST [2,16.6%]		
		BRONCHOGENIC CYST [1,8.3%]		

Table 3. Distribution of mediastinal masses

DOI: 10.14260/jemds/2015/1440

MARGINS	ATTENUATION	ENHANCMENT PATTERN	ASSOCIATED FINDINGS
ILL DEFINED [14,28.0%]	SOFT [34,68.0%]	HOMOGENOUS [11,22.0%]	INVOLVEMENT OF ADJACENT STRUCTURES [24,48.0%]
WELL DEFINED [36,72.0%]	CYSTIC [23,46.0%]	HETEROGENOUS [22,44.0%]	LUNG FINDINGS [32,64.0%]
	CALCIFICATIONS [22,44.0%]	RIM [7,14.0%]	BONE INVOLVEMENT [7,14.0%]
	FAT [2,4.0%]	INTENSE [10,20.0%]	

Table 4. CT Charaecteristics of mediastinal masses

CT DIAGNOSIS	NO. OF CASES	HPR NO. OF CAES	FINAL DIAGNOSIS
LYMPHOMA	7	7	LYMPHOMA
LYMPHOMA/THYMOMA	2	2	LYMPHOMA
THYMIC MASS -THYMOMA	5	5	THYMOMA
THYMIC MASS-THYMIC CA	1	1	INVASIVE THYMOMA
THYMIC MASS-THYMIC CA	1	1	THYMIC CARCINOMA
MNG	5	5	MNG
GCT- TERATOMA	2	2	IMMATURE TERATOMA
ANEURYSMS	10	-	ANEURYSMS
TUBERCULOUS LN	3	2	TUBERCULOUS LN
METASTATIC LN	5	5	METASTATIC LN
MEDIASTINAL PSEUDOCYST	2	-	MEDIASTINAL PSEUDOCYST
BRONCHOGENIC/OESOPHAGEAL DUPLICATION CYST	1	1	BRONCHOGENIC CYST
NERVE SHEATH TUMOUR	4	4	SCHWANNOMA
PARAVERTEBRAL ABSCESS	2	-	PARAVERTEBRAL ABSCESS
TOTAL	**50**	**35**	

Table 5. CT Diagnosis and final diagnosis

DOI: 10.14260/jemds/2015/1440

FIGURE 1: Teratoma: Frontal chest radiograph (a) of 1yr old child with difficulty in breathing showing oval shaped opacity in right hemithorax with positive hilum overlay sign. NECT thorax (b) showing well defined mass in the anterior mediastinum with fat and soft tissue components. Heterogeneous enhancement of the mass on contrast study(c, d).

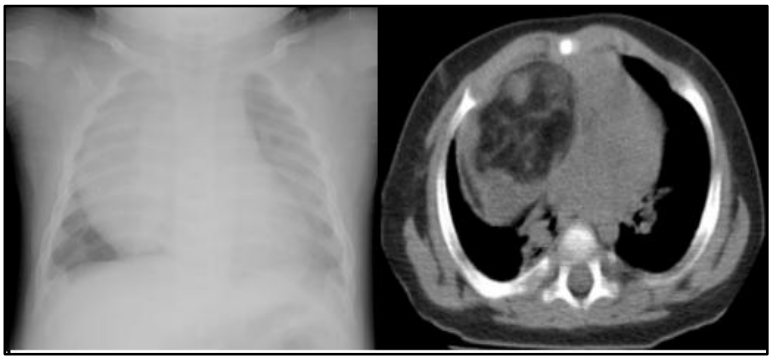

Fig. 1A & B

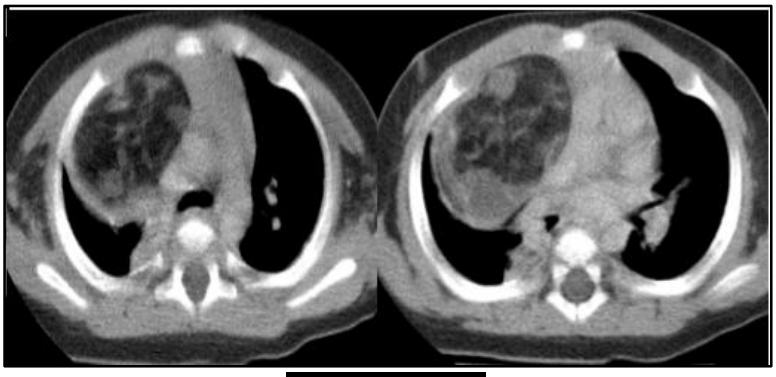

Fig. 1C & D

FIGURE 2: Invasive thymoma: Axial NECT (a) thorax in a 44yr old male patient with cough and breathlessness, showing soft tissue density mass with specks of calcifications in the anterior mediastinum. Heterogeneous enhancement (b) of the mass noted on contrast study. CT guide biopsy (c) of the mass proved to be invasive thymoma on histopathology (d), round/polygonal epithelial cells noted with reduced lymphocytes.

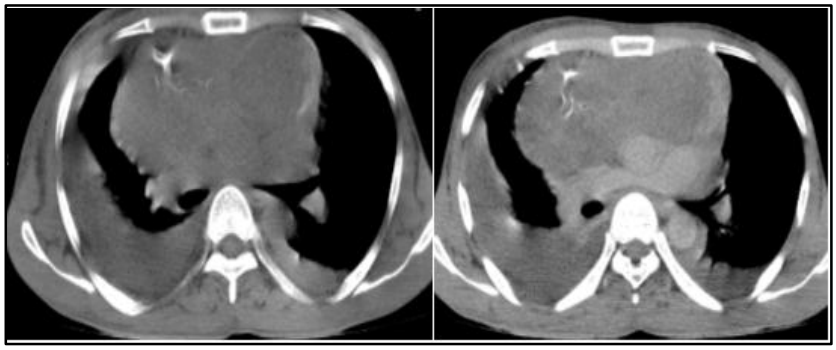

Fig. 2A & B

DOI: 10.14260/jemds/2015/1440

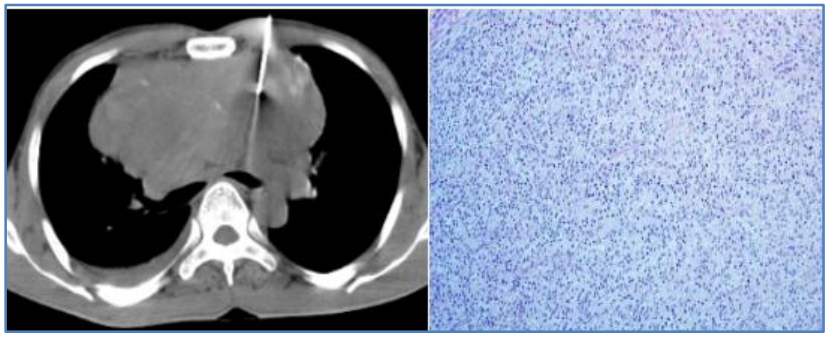

Fig. 2C & D

FIGURE 3: Non Hodgkins Lymphoma in a 32yr old female: Frontal chest radiograph (a) showing mediastinal widening and blunting of costophrenic angles. Axial non-contrast (b) and contrast(c) CT showing ill-defined heterogeneously enhancing anterior and middle mediastinum mass encasing the major vessels of neck. Bilateral enlarged axillary lymphnodes seen. Histopathology proved the mass to be Diffuse Large B cell Lymphoma (d), showing vague bands of sclerosis and centroblastic cells surrounded by fibrotic stands.

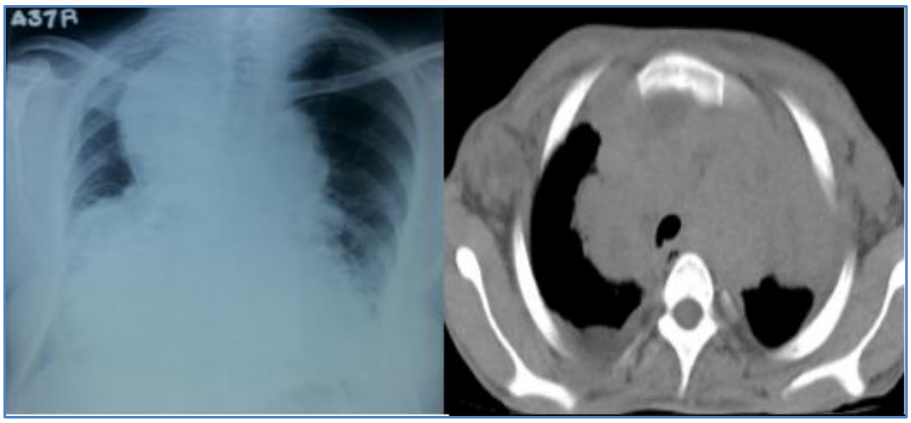

Fig. 3A & B

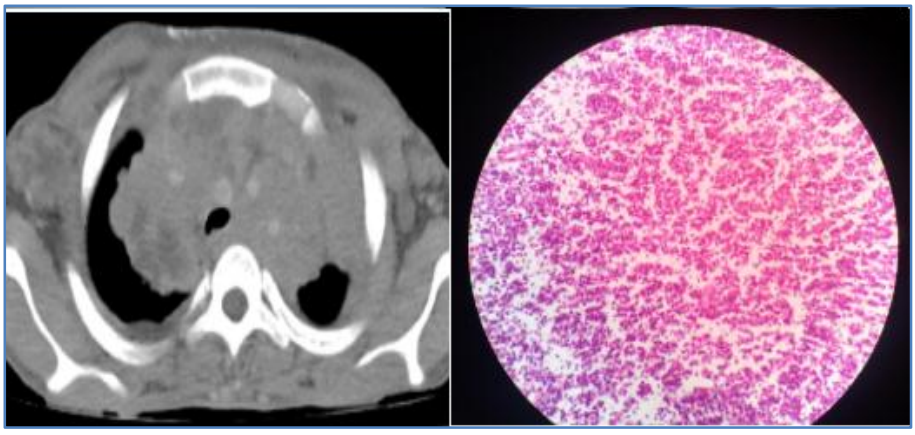

Fig. 3C & D

DOI: 10.14260/jemds/2015/1440

FIGURE 4: Mediastinal pseudocyst in a 30yr old alcoholic male patient: Axial non-contrast CT showing bulky pancreas. Contrast study shows intrapancreatic pseudocysts, (b) pseudocyst in posterior mediastinum(c, d) and minimal left pleural effusion.

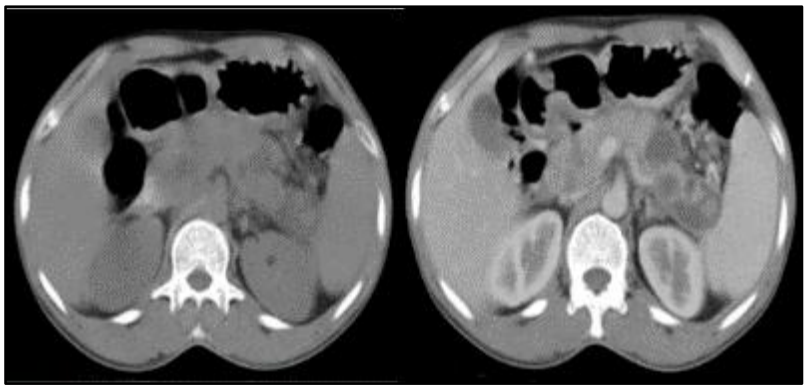

Fig. 4A & B

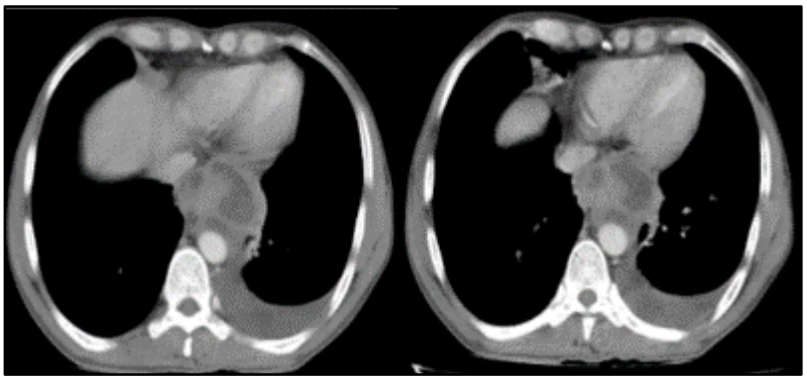

Fig. 4C & D

FIGURE 5: Multinodular goitre with anterior mediastinal extension in a 40yr female: NECT showing soft tissue mass with cystic areas and specks of calcifications in anterior mediastinum (a). Contrast axial (b) and coronal reformatted images(c) showing heterogeneous enhancement of the mass extending from neck into the anterior mediastinum. Histopathology (d) proved the mass to be multinodular goitre, Collections of variably sized and shaped follicles, form irregular lobules. The follicles are distended with colloid.

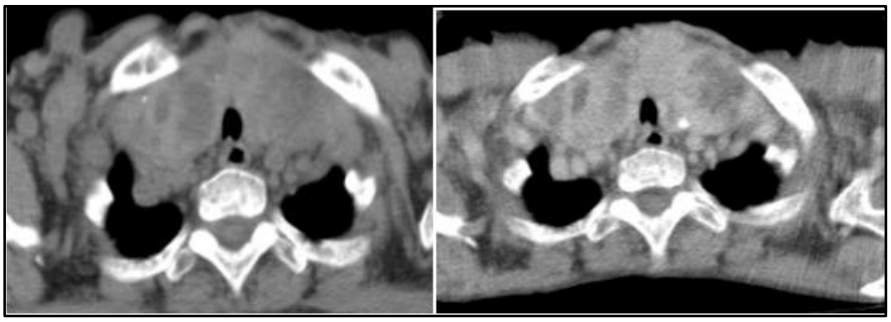

Fig. 5A & B

DOI: 10.14260/jemds/2015/1440

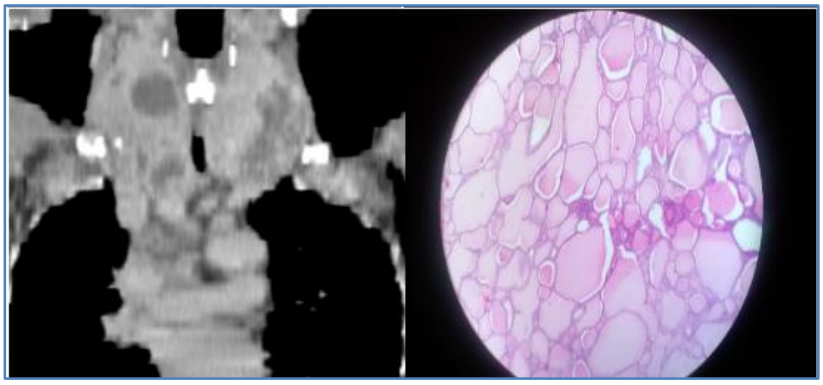

Fig. 5C & D

FIGURE 6: Schwannoma: Frontal chest radiograph (a) in a 36yr female showing round homogenous opacity in the left hemithorx. Blunting of left costophrenic angle seen. Axial NECT (b) and contrast(c) images showing heterogeneously enhancing mass in the posterior mediastinum and left pleural effusion. Histopathology proved to be schwannoma (d), Primarily compact hypercellular Antoni A areas.

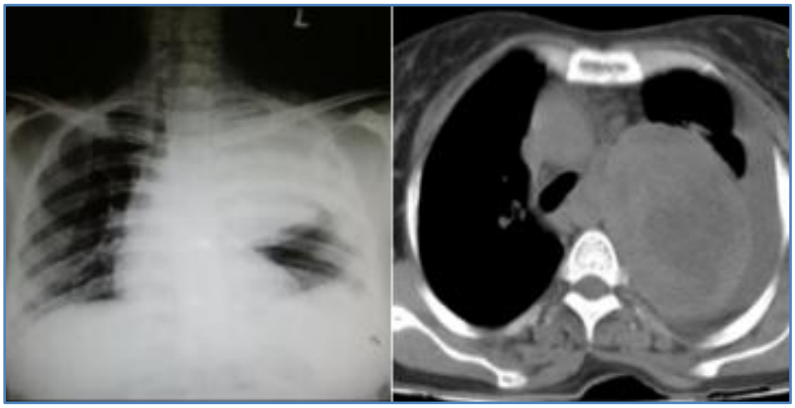

Fig. 6A & B

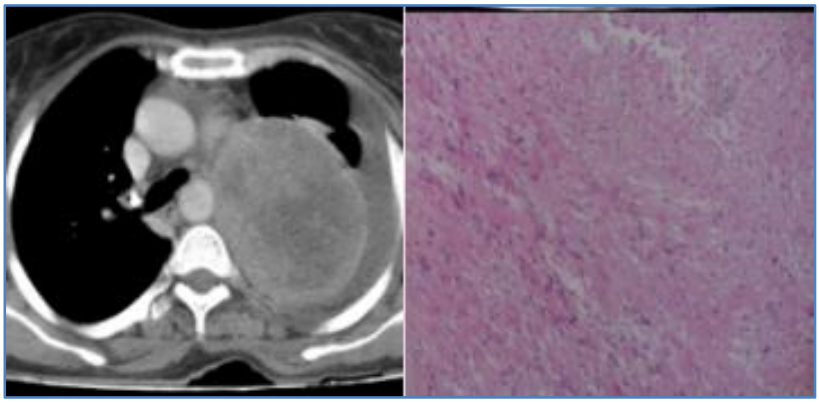

Fig. 6C & D

DOI: 10.14260/jemds/2015/1440

FIGURE 7: Aortic aneurysm: Frontal chest radiograph (a) in a 62yr old male with cough and breathlessness showing opacification of left hemithorax. Contrast axial (b) and coronal (c) reformatted images shows intensely enhancing large aortic aneurysm with non-enhancing thrombus within. Aneurysm is compressing the left main bronchus resulting in collapse of left lung. Moderate left pleural effusion noted. Sagittal reformatted image (d) in bone window showing erosion of vertebral bodies by long standing aneurysm.

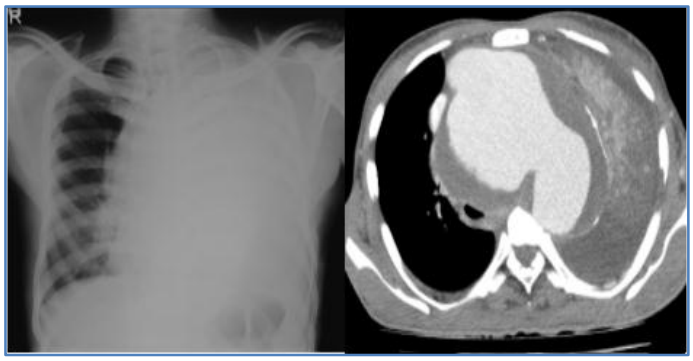

Fig. 7A & B

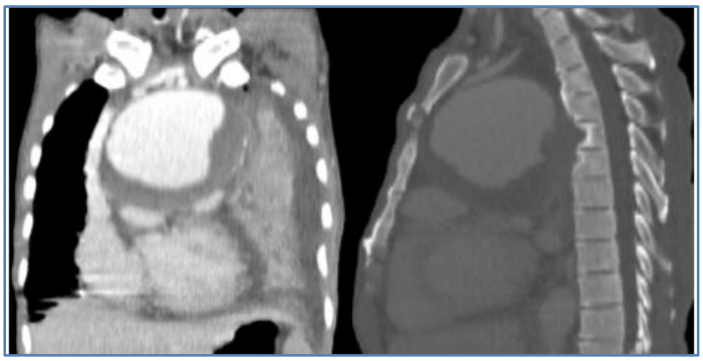

Fig. 7C & D

FIGURE 8: Saccular aneurysm of aortic arch: Frontal chest radiograph (a) in a 43 yr old asymptomatic man showing round opacity in left hemithorax silhouetting left cardiac border. Axial NECT (b), contrast axial(c) and coronal reformatted images showing intensely enhancing partially thrombosed saccular aneurysm of aortic arch.

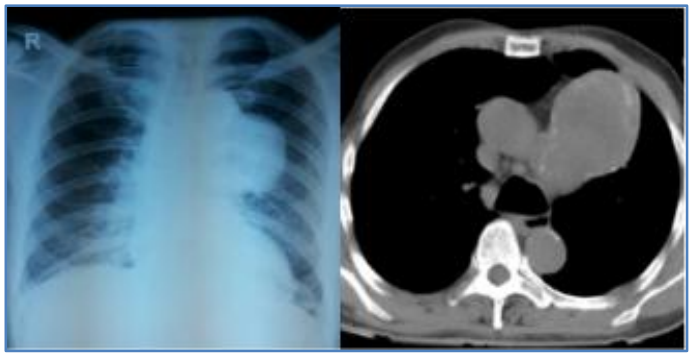

Fig. 8A & B

DOI: 10.14260/jemds/2015/1440

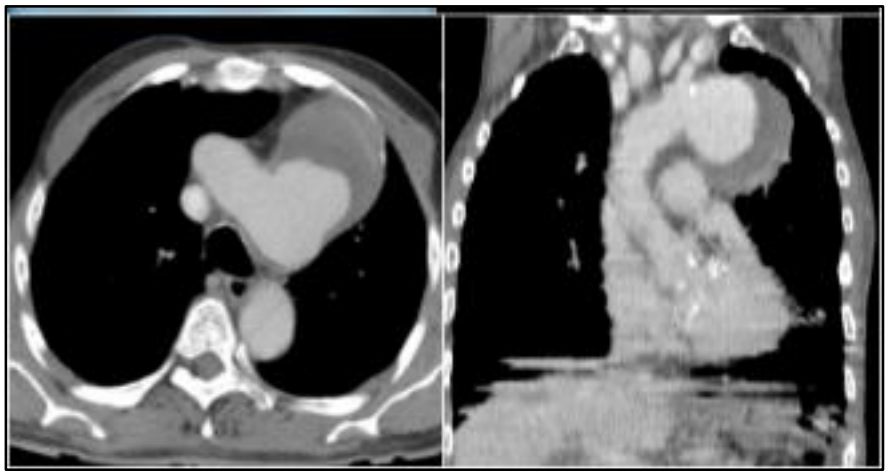

Fig. 8C & D

AUTHORS:

1. Shashikumar M. R.
2. Rajendra Kumar N. L.
3. Nanjaraj C. P.
4. C. N. Pradeep Kumar
5. Manupratap N.
6. Chandrashekar H. M.

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Radiodiagnosis, MMC & RI, Mysore.
2. Associate Professor, Department of Radiodiagnosis, MMC & RI, Mysore.
3. Professor & HOD, Department of Radiodiagnosis, MMC & RI, Mysore.
4. Assistant Professor, Department of Radiodiagnosis, MMC & RI, Mysore.
5. Assistant Professor, Department of Radiodiagnosis, MMC & RI, Mysore
6. Post Graduate, Department of Radiodiagnosis, MMC & RI, Mysore.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Shashikumar M. R,
#241, 1st Stage,
Brindavan Extension,
Mysore-570020.
E-mail: drmrshashikumar@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS: None

Date of Submission: 07/07/2015.
Date of Peer Review: 08/07/2015.
Date of Acceptance: 10/07/2015.
Date of Publishing: 15/07/2015.